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IMPACT OF RADIATION FROM WIRELESS COMMUNICATION DEVICE ON HUMAN

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ABSTRACT

As the time changes, so the communication mode is also. With the fast growth in technology wireless communication becomes more dominated in comparison to wired communication. But due to this, human living organisms are increasingly exposed to microwave / radio frequency (RF) radiation from wireless communication technology including the mobile phones and base stations. So the objective of this paper is to summarise the effects of RF radiation, factors affecting the body exposure and remedies to avoid harmful effects.

I. INTRODUCTION

Wireless communication is enjoying its fastest growth due to the tremendous increase in the number of mobile users, equipment and systems. Today global number of mobile phones has exceeded two thousand million phones and the number of mobile pc (laptops) four hundred millions, which are significantly more than wired systems .In all universities there are a lot of Wi-Fi devices mainly for internet services and almost every student have laptop to enjoy free Wi-Fi services. So to provide a good service and quality communication to users, number of serving terminals i.e. antennas, base stations also increasing .The conflict rise when public concern about radio frequency radiation comes out from the wireless devices. No one has definitely proof that radiation from the cellular phones are harmful for human body, but there is no proof that they are harmless. A large number of research projects were started to understand the biological effects.

BIOLOGICAL EFFECT VERSUS HAZARDS:-

Pharmaceutical drugs, such as aspirin, when taken in a small amount that is 650 mg every four hours, have biological effects human gets relieve from headaches or the pain of arthritis. On the other hands if the doses of aspirin are increased by a factor of 10 or 100, then the drug can be toxic i.e. a Hazards.

So if a specified RF exposure produces a biological effect, the effect must be evaluated for its potential as a hazard to humans.

Any living organism has abilities and tolerance to the change, these effects may be well within the capability of the organism to maintain normal equilibrium. On the other hand, an effect of such intense nature that recovery capability of any living organism is overcome by the radiation exposure, then the effect may be considered as hazard.

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So the biological effect as a result of RF exposure may be 'Hazardous' or 'adverse'. There may be biological effect occurring at low level of RF exposure, associated with the use of cellular or mobile phones. But this does not mean that these effects will lead to disease. Since the living organism (body), has the capacity to overcome these effects to maintain normal homeostasis.

REASON BEHIND THE INTERACTION WITH RF WAVES OR RADIO WAVES:-

In all living systems there are biological activities such as charge transport, polarization and electromagnetic field generation. The potential difference between cell membrane is of order of 10 mv and the electric field intensity inside the membrane is about 10^6 -10^7 v/m. In our brain or in the other part of the body nerve signals are transmitted along the axons by means of electric pulses.

The brain and heart activities generate electric and magnetic fields. Since there are static and low frequency field, sometimes high frequency field may also be generated in living systems even in microwave range .

External electromagnetic field interact with biological systems in various ways .There may be breakdown of cellular membranes and fusion of cells due to the electric field some non thermal effect are such that polarization resulting in pearl change formation and rotation of cells . Some thermal effects are auditory and ocular once.

Besides the cell membrane, the effect to the nucleus and DNA should also be considered. Blank and Reba stated that microwave can the change the DNA molecule, because there are charges on the DNA double helix.

The interaction between the microwave and charge will disturb the gene .

FACTORS AFFECTING THE INTERACTION OF BIOLOGICAL ACTIVITY WITH RF RADIATION:-

1. Frequency of operation
2. Intensity
3. Duration of exposure
4. Amount of exposure period
5. Specific absorption rate
6. Effect are different from one human to another
7. Distance of base station antenna

1. FREQUENCY OF OPERATION:-

EM waves have two forms: Ionizing and Non- ionizing.

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Ionizing: - These waves are located over visible light range .In this single photon has energy to pull out an electron from an atom.Due to this chemical changes may take place, including tan and sunburn (ultra-violet) rays or for harder radiation (x and gamma rays) mutations and cancer.

Non-ionizing: - The lower frequency , invisible light , microwave and all the frequency used for communication , the energy of single photon is not enough to pull out an electron from an atom , this radiation is called non ionizing. But continuous exposure to many photons can produce thermal and non- thermal effects.The thermal effects are like burns, when the temperature increases beyond the maximum limit tolerated by the cells.Non thermal effects are related to direct interactions of electromagnetic fields with cells in living organism. Thermal effects can take place at lower power level.

2. INTENSITY: -

Theoretical and experimental studies over several frequency band showed that a microwave power density up to 10 m watt/cm^2 (100w/m^2) could be tolerated even for long periods of time .Infrared radiation from the sun can reach 100 m watt/cm^2 (1 kilowatt/m^2) i.e., 10 times more .many service provider /operators work for many years within the limit.

3. AMOUNT OF EXPOSURE PERIOD: -

Henry Lai from bioengineering department of Washington University performed experiment on the mice covering on the frequency of the operation, intensity, duration of exposure and amount of exposure period. Mice have nearest biological characteristics as humans.

1. Lai gave the result that over a period of RF exposure it could worsen the damage of that nervous system compared to shorter period of time.
2. A low intensity of RF but with a larger period of exposure and a high intensity of RF with a shorter period of time will have same effects.

So from this experiment it was shown that, in control amount of exposure at a certain period level could help in treatment of some diseases but more careful analysis must be conducted before use RF exposure as treatment to diseases. This is

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true because the effect of RF radiation is different from one human to another. It depends how strong the body of a person to react over the amount and period of RF absorption.

4. SPECIFIC ABSORPTION RATE (S.A.R.):-

S.A.R. is the measurement of rate by which a body absorbs energy when the body is exposed to radio frequency electromagnetic field.

We can also say that it is a measure of absorption of EM wave energy by tissues. It defined as power absorbed per mass of tissue and has unit's watts/ kilogram.

Absorption rate is observed either for whole body or for a small sample volume of tissues.

The frequency range for the calculation of absorption rate is100 kHz to 10 GHz

It is mostly used for the power absorption from mobile phones and during MRI scans.

Its value depends on two factors:-

1. The geometry and the location of the RF source.

2. Depends on which part of body is exposed to the RF energy.

For example the S.A.R. value is more when the phone is situated near the head in a talk position. The absorption rate is more in that case in entire head.

The government of different countries have defined safety limit on the RF energy produced by mobiles phones that mainly exposes head or a limb .

(a) United States:-FCC requires that phones should have a SAR level at or below 1.6 watts / kilogram for a sample volume of 1 gram mass of tissue.
(b) European Union: S.A.R. limits within the EU are specified by CEN ELEC , following IEC standards. For mobile phones, and other such hand held devices, the SAR limit is 2w/kg averaged over 10g of tissue. (IEC 62209 –1).

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Safety standards of maximum permissible S.A.R.

TABLE 1:frequency range between 100 kHz-6 GHz.

STANDARD	LOCAL S.A.R. IN HEAD (W/KG)	
	PUBLIC	OCCUPATION
ARPANSA	2	10
SAFETY CODE 6[6]	1.6	8
ICNIRP [7]	2	10
FCC [8]	1.6	8
NRPB [9]	10	10

Except ANSI/IEEE -averaging time is 30 minutes; all S.A.R. values are to be averaged over any six minute time interval.

TABLE 2:S.A.R. Value is different for different mobiles.

Brand	Model	OS	S.A.R.(w/kg)
LG	OPTIMUS 2X	ANDROID	0.545
HTC	NEXUS ONE	ANDROID	0.37
BLACK BERRY	TORCH	BB OS 6.0	0.91
MOTOROLA	FLIPSIDE	ANDROID	0.5
APPLE	IPHONE4	ios 5.1	0.93
NOKIA	E5	SYMBIAN	0.88
SAMSUNG	Smily		0.43
SAMSUNG	CONTOUR		0.49

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5. EFFECT OF RF RADIATIONS IS DIFFERENT FROM ONE HUMAN TO ANOTHER:-

The effect of RF radiation is different from one human to another . It depends how strong the body of a person to react over the amount and period of RF absorption. The electromagnetic field produces defective cells inside the body and these cells are destroyed by human immune system. Experiments show that the immune system and production of bad cells varies from human to human.

6. DISTANCE OF BASE STATION ANTENNAS:-

Eight of the ten studies reported increased prevalence of adverse neuron behavioural symptoms or cancer in populations living at distance < 500 meters from base stations.

7. CELLULAR USER ACTIVITY (LISTENING OR TALKING ON MOBILE PHONE):-

Mobile phones/devices use electromagnetic wave for communication or transmission of any information through air. In other words mobile phone and the base station are connected to each other via RF link. So there are two sources of exposure: base station antennas and handset (mobile phone). The received signal is always weak due to attenuation of power in multipath environment. So the effect of radiation is low when the user is listening. However when the user is talking; the signals are stronger and the radiation are near to human head. So this can cause a headache to human.

II. CONCLUSION

To minimize the impact of radiation on human:-

- There should be some law in every country for hearing on public health threat by exposure to transmitted radio frequency radiation.

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- Radiation emitting devices should require some health testing prior to approval.
- Continuously transmitted devices should be banned.
- There should be some warning label on the cell phones and cordless phones.
- There must be some national programmer to educate the public about wireless radiation exposure.
- More use of fiber communication and wired network.

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